A Time Projection Chamber (TPC) for particle tracking is being developed at BNL by the Laser Electron Gamma Source (LEGS) group and the Instrumentation Division for use at beamline X5 at the NSLS. It will be part of the Spin ASYmmetry Detector Array (SASY) for LEGS experiments. The TPC will be used to discriminate between π^+ and π^- particles by measuring their track curvatures in a magnetic field of 1.8 Tesla. It is composed (see Fig. 1) of a cylindrical can 90cm long and 36 cm in diameter with a high-voltage electrode in the middle, a dual-stage Gas Electron Multiplier (GEM) with associated anode pad plane and dedicated front-end electronics at one end , and a ground electrode with HV and filling gas connections at the other end.. Charged particles traversing the gas create tracks of electrons and ions along their paths. The electrons in the tracks drift toward the anode plane in a field of up to 400V/cm, for a maximum drift time of about 10μs. The double GEM provides an electron gain of about 500. The multiplied electrons are collected by the anode plane, which is pixellated into about eight thousand pads to provide a digitized representation of the projection of the tracks. The time of arrival of the drifting electrons (relative to a trigger scintillaror surrounding the TPC) at each pad is measured and digitized by the dedicated front-end electronics.

The TPC will be filled with mixtures of up to three of the following gasses: argon, methane, ethane, carbon dioxide, and carbon tetraflouride. These mixtures will be prepared by a gas handling system which can also re-circulate and purify the gas. The TPC (a volume of 0.085 cubic meter) will operate at the local atmospheric pressure and the gas system will store about 5 times the TPC volume at a pressure of three atmospheres. A current limited 25 kV high voltage supply with an external RC filter will be connected to the cathode at the center of the TPC by a coaxial HV cable and a custom connector. The GEM foils will be biased by 1 kV current limited supplies, and low voltage (2 to 5 volts at up to 50 amp) supplies will operate the circuitry for the electronic readout. The TPC and its readout electronics will be contained inside a 1.8 Tesla superconducting solenoidal magnet. The cryostat for this magnet is 100 cm long with an inside bore of 50 cm. The magnet is cooled with liquid helium.

The present schedule calls for the completion of the construction of the TPC itself by August 1, 2005. The gas handling system exists and has been in operation in the Physics Department for about 2 years. The superconducting solenoid, in the steel magnet yoke, is being tested now in Bldg 902, and will be moved to X5 at the NSLS by September. In October the yoke and superconducting solenoid will be installed around the existing SASY detector array, and by the beginning of November the TPC will be installed inside the solenoid.

Dimensional Data for the SASY TPC and Solenoidal Magnet

All dimensions are in millimeters, unless stated explicitly

Item	Clearance	Diameter	Radial Location
Yoke opening minimum Dia x length:		552.4 x 1048 long (21.75" x 41.25")	276.2
Radial gap to cryostat:	26.2		
Opening in XTAL Box:		515 x 515, 817 long (Al-Al outside)	257.5
Radial clearance:	1		
Plastic paddles to identify gammas converted by cryostat:		5.5 thick, radially (3/16" scintillator)	253.8 Center
Radial clearance:	1		
Cryostat maximum OD:		500 (19.685")	250.0
Cryostat thickness:	61		
Cryostat minimum ID:		378 (14.882")	189.0
Radial clearance:	2		
TPC end flange maximum OD		373.9 (14.720")	186.9
Radial clearance:	NA		
TPC trigger detector (VPI) maximum OD:		373.9 (14.720")	186.9
Scintillator thickness:	5.5 (3 scintillator + 2.5 wrapping)		
TPC trigger detector (VPI) minimum ID:		362.9 (14.327")	181.4
Radial clearance:	0.35		
TPC outer can, supports, & field cage maximum OD		362.2 (14.258")	181.1
Outer can thickness:	2.0		
TPC outer can, supports, & field cage minimum ID		357 (14.055")	178.5
Active region:	135		
TPC inner can, supports, & field cage maximum OD		86 (3.386")	43.0
Inner can thickness:	1.0		
TPC inner can, supports, & field cage minimum ID		84 (3.307")	42
Radial clearance:	2.0		
SPHICE cryostat maximum OD:		80 (3.150")	40
Gamma-ray Beam			0

TPC active radial extents:	43.5 to 178.5 (135 thick)
TPC active axial extents:	-200 to +300 (500 long)

Prepared April 15, 1999 by ock and cet
Revised June 4, 1999
Revised November 19, 1999
Revised May 16, 2000
Revised December 2001 to accommodate Quantum Tech IBC
Revised February 24, 2003 to reflect UVA Lucite machining experience
Revised May 16, 2003 to reflect insertion of diameter gauge into solenoid
Revised June 21, 2005 reflect measurements of actual TPC cans and to include yoke
File: TPC Dimensions 7.doc